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TITLE: Family Maltreatment, Substance Problems, and Suicidality: Prevalence Surveillance and Ecological Risk/ Protective Factors Models

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13. SUPPLEMENTARY NOTES

14. ABSTRACT
This study seeks to derive and validate an innovative public health surveillance system. Years of pilot work with the AF found that it is possible to derive accurate complex statistical estimation algorithms from data sets containing both nonsensitive information and assessments of secretive problems. These algorithms can then be applied to data sets that do not directly assess secretive problems to accurately estimate problem prevalences. In other words, a single survey administration and the algorithms can obviate the need for future secretive behavior surveys, making this a cost effective and sustainable planning tool. Further, the data set to be used for algorithm derivation will also be ideal to test a series of specific hypotheses about individual, family, workplace, and community risk and protective factors for each of the secretive problems.

15. SUBJECT TERMS
Readiness, prevention, risk factors

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INTRODUCTION:

Of the many concerns about AF's force behavioral health protection, AF commanders identify secretive problems (family maltreatment, suicidality, and problematic alcohol/drug use) as 3 of the top 5 concerns. These problems are prevalent — the PRMRP-funded pilot study for the current proposal revealed that 25% of AF members reported at least one secretive problem at a serious level, yet only 1 out of 6 of these airmen report that anyone in the AF knows that they are having problems. Yet, the AF currently has no system to routinely track prevalences. Further, enormous gaps exist in our knowledge about risk and protective factors for these problems, especially in military communities. This study seeks to derive and validate an innovative public health surveillance system. Years of pilot work with the AF have found that it is possible to derive accurate complex statistical estimation algorithms from data sets containing both nonsensitive information and assessments of secretive problems. These algorithms can then be applied to data sets that do not directly assess secretive problems to accurately estimate problem prevalences. In other words, a single survey administration and the algorithms can obviate the need for future secretive behavior surveys, making this a cost effective and sustainable planning tool. Further, the data set to be used for algorithm derivation will also be ideal to test a series of specific hypotheses about individual, family, workplace, and community risk and protective factors for each of the secretive problems.

BODY:

Year 1

Completed   *Task 1*   *Complete data cleaning, screening, and missing data analyses as described in proposal.*

The data from all individuals who logged into the survey ($N = 54,543$) were analyzed, and three general patterns of missingness were observed. First, a few individuals ($n = 1369$) ended their participation without answering even the first few questions asking for basic demographics; these were considered non-respondents and were removed from the dataset. Of those remaining, over 75% ($n = 42,215$) continued responding until the end of the survey, while the rest ($n = 10,959$) ended their participation at some point in between. Although the amount of missingness was lower than expected given the nature of the survey, it was not low enough to be ignored (Allison, 2001).

All who had entered "Other" as their location rather than selecting a base and could therefore not be weighted ($n = 305$) were removed from the dataset. Also, because it was likely that both members of at least a few dual-AD couples would have participated (creating possible problems of nonindependence), we used certain data points (e.g., military status of self and spouse, gender, base location, date of last change of base, type of housing, length of marriage, number and ages of children in the home) to "match up" these couples ($n = 55$ couples). One member of each such couple was then randomly chosen and removed from the dataset, as were 34 individuals whose responses were suspect (e.g., who endorsed every possible act of parent-child physical assault).

Completed   *Task 2*   *Complete missing data imputation.*

Once we had confirmed that the CA was psychometrically sound (see Snarr, Heyman, & Slep, 2007), it was scored, and all item-level information therefore captured by summary variables was removed. Significantly non-normal variables were transformed appropriately, and multiple imputation was then conducted separately by gender. IVEware (Raghunathan, Solenberger, & Van Hoewyk, 2002) was used due to its ability to readily handle large, complex datasets comprising variables of various types (e.g., continuous, semi-continuous, categorical, dichotomous, count). Fifty iterations of multiple imputation were conducted, with every 10th resulting dataset saved, and all values that had been imputed for legitimately "not applicable" data points were then removed from

the five resulting datasets.

AD members were naturally clustered at bases. Each base was a distinct subpopulation of the AF. In sampling terms, bases were strata. We developed post-stratification weights to adjust for base population, which varied from the AF population because (a) smaller bases were oversampled; and (b) non-response differed across bases. (We treated members as being randomly sampled within the base.) We then used raking to adjust the weights for the variables considered in the sampling design; these included sex (male/female), rank (E1-E4, E5-E6, E7-E9, O1-O3, O4 and above), race/ethnicity (white, black, Hispanic, other, unknown), Air Force Specialty Code (acquisition, logistics, medical, Office of Special Investigations, other, other operations, pilot, professional, support), religion (Christian: Protestant, Christian: Roman Catholic, Christian: Evangelical, Non-Christian, unknown), and base. Finally, extreme weights (more than four times the size of the mean weight) were trimmed. This is typically done so that extreme weights do not overly influence results and do not result in large sampling variances (e.g., Potter, 1988).

Completed   Task 3   *Derive, validate, and develop confidence intervals for the first two – three algorithms:*
- Male to Female Partner Physical Abuse (substantiatable)
- Male to Female Partner Physical Abuse (sub-threshold)
- Male to Female Partner Emotional Abuse
- Male to Female Partner Sexual Abuse

This involves the steps outlined in the proposal – calculating possible interactions, deriving logistic regression equations via hierarchical backwards stepwise logistic regression, identifying the optimal cutpoint, crossvalidating the equation and deriving bootstrapped confidence intervals. Because we are working with multiply imputed data, each of these analytic phases occur on each of the five imputed data set and results are integrated. The validation is expected to be completed by the end of May.

In Progress   Task 4   *Test all hypothesized risk/protective effects and develop and validate regression and structural equation modeling based models for first dependent variables:*
- Partner Physical Abuse (substantiatable)
- Partner Physical Abuse (sub-threshold)
- Suicidal Ideation
- Suicidal Behavior

These analyses are underway. Bivariate risk associations have been calculated on each of the imputed data sets, aggregated appropriately, and cross-validation in underway; we are currently considering additive and interactive effects both within and across multiple ecological levels (i.e., individual, family, organization, community) and preparing for the structural equation modeling (which must be done with MPlus – a different software package than that used for analyses up to this point). We expect initial results by June, 2008, but do not have formal results available at the time of this report.

Completed   Task 5   *Present project goals, progress, and challenges at meetings with Military Advisory Panel in June and December, 2007.*
As of the December, 2007 meeting, data preparation and initial analyses to ensure we were appropriately handling analytic challenges were still underway. Much of the discussion was informal because the issues were more about statistical analysis than proper interpretation in light of the military context. Presentation materials are attached.

In Progress   Task 6   Write reports detailing algorithms developed and risk/protective factor analyses completed in Year 1 and brief to AF leadership.
        We have begun to draft the reports on the completed algorithms. As soon as the validation is completed, we will be able to finalize the reports.

KEY RESEARCH ACCOMPLISHMENTS: Bulleted list of key research accomplishments emanating from this research.

- o Despite the length of the survey (~90 min.), 75% of participants continued responding until the end of the survey.
- o In spite of the sensitive nature of secretive problems, some (though perhaps not all) AF AD members who have such problems were willing to disclose this fact within the context of an anonymous survey. This makes the algorithmic and risk/protective factor analyses being conducted in this project possible.
- o For both genders, although the exact order differed slightly, the strongest bivariate predictors of suicidal ideation at this point in the analyses were depressive symptoms (strongest by far), personal coping ability, physical health, and satisfaction with the Air Force as a way of life.
- o Among individuals reporting suicidal ideation, however, depressive symptoms appear to not be significantly predictive of actual suicide attempts. For men, the strongest predictor of suicidal behavior (given suicidal ideation) at this point in the analyses were alcohol abuse; for women, it was partner violence.
- o For men, the strongest bivariate predictors of *sub-threshold* partner abuse (i.e., aggressive acts without consideration for impact) at this point in the analyses were relationship satisfaction and alcohol problems; for women, the strongest predictors at this point in the analyses were relationship satisfaction and family coping ability.
- o For men, the strongest bivariate predictors of *substantiatable* partner abuse (i.e., aggressive acts with harmful impact) at this point in the analyses were parent-child physical aggression perpetration, alcohol abuse, and depressive symptoms; for women, the strongest significant predictors at this point in the analyses were family income and financial stress.

REPORTABLE OUTCOMES: Provide a list of reportable outcomes that have resulted from this research to include:

Although we expect reportable outcomes in the next several weeks, at this point, none of our findings have been vetted through the final cross-validation process and therefore have not begun to be reported.

CONCLUSION: The purpose of this project is to (a) develop and validate the accuracy of an innovative surveillance system (AF-wide) for family maltreatment, suicidality, and problematic alcohol/drug use, as well as (b) test a series of hypotheses regarding risk and protective factors for secretive problems in AF communities.

REFERENCES: List all references pertinent to the report using a standard journal format (i.e. format used in *Science, Military Medicine*, etc.).

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APPENDICES:

Not Applicable

SUPPORTING DATA: N/A

Secondary Analyses of CA+ Data: Algorithms and Risk/Protective Models

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Introduction

- **CA+ includes**
  - 21 scales assessing
    - Community functioning
    - Workplace functioning
    - Family functioning
    - Individual functioning
  - 9 measures assessing
    - Suicidality
    - Alcohol problems
    - Prescription drug misuse
    - Illicit drug use
    - Partner maltreatment (emotional and physical)
    - Child maltreatment (emotional and physical)

Introduction

- **Data collected from**
  - 52,869 AD members
    - Including 37,410 partners
    - 28,637 parents
  - 19,992 Civilian spouses

Introduction

- **Obviously, much can be learned from these data**
  - Only prevalences of problems and zero-order risk relations are considered in NORTH STAR
- **So, two proposals were developed**
  - CDC proposal on risk and protective relation modeling
  - DoD proposal on a subset of models and prevalence estimation algorithms

Introduction

- ■ **Both funded**
  - To eliminate overlap, parallel risk/protective models will be tested in two versions of the data
    - ◆ Weighted to demographically match the Air Force
    - ◆ Weighted to demographically match comparable U.S. population (employed civilians in same age range)
  - Prevalence estimation algorithms will be developed and cross-validated

RPF Study

■ With respect to all the problem behaviors, the literature is best developed for zero-order risk factors

– Although ecological theories exist, these have seldom been tested

– Although most agree that there are important interactive buffering effects in play, these have seldom been tested

– Generalizability of effects has also been difficult to establish (Same for different family compositions? Ages of children?)

Aims

- So, for each of the specific problem behaviors and comorbid outcomes outlined in the proposal (i.e., 14 dependent variables in total), we will
  - Test a set of hypothesized risk relations
  - Test hypothesized interactions between risk and protective factors
  - Identify additive protective effects
  - Propose, test, and cross-validate through multigroup analysis, overarching models
  - Test the generalizability of all findings across various sociodemographic subgroups

Dependent Variables

- Parental physical aggression
- Child physical abuse
- Child emotional abuse
- Partner physical aggression (male-to-female and female-to-male)
- Partner physical abuse (male-to-female and female-to-male)
- Suicidal ideation
- Suicide attempts (n = 158)
- Alcohol problems
- Alcohol dependence
- Illicit drug use
- Prescription drug misuse
- Partner and child physical abuse
- Partner abuse and alcohol problems
- Partner abuse and suicidality

Analytic Strategy

- ■ Weighting
  - – Trying to minimize number of replication weights and ensure all variability of interest is not relegated to error

- ■ Imputation

- ■ Conduct analyses in WesVar when possible, MPlus when not to account for clustering as well as we can

Analytic Strategy

- Examine effect sizes, not just statistical significance

- Test zero-order risk relations with correlations

- Test interactive protective hypotheses with simultaneous linear or logistic (depending on the nature of the DV) regressions

Analytic Strategy

■ **Identify additive protective effects**

– Randomly divide dataset in two to allow for replication

– Backward stepwise hierarchical regression (logistic or linear)

◆ The main effects that contribute to the interactions to be tested will be entered simultaneously on the first step

◆ Main effects and/or interactions being tested for additive effects will be entered on the second, backward stepwise, step

Analytic Strategy

■ **Identify additive protective effects**
  – Conduct two sets of regressions to identify additive protective effects at the level of the variable:
    ◆ *within risk factor, across protective factors* – to identify whether particular combinations of protective factors provide unique buffering of the specified risk factor, while other combinations provide redundant buffering
    ◆ *within protective factor, across risk factors* –to identify whether there are protective factors that are particularly effective in buffering the effects of a wide variety of additively predictive risk factors

Analytic Strategy

■ **Identifying additive protective effects**
  – Retaining only significant predictors from the above regression models, conduct another two sets of regressions to identify additive protective effects at the ecosystem level
    ◆ within risk factor level across protective factor level
    ◆ within protective factor level across risk factor level

■ **Final regression models will be re-run in the cross-validation sample**

Analytic Strategy

■ **Structural Equation Modeling**

– If a moderate number of additive effects are retained in the second set of regressions, we will propose, test, and cross-validate through multigroup analysis, structural equation models

Analytic Strategy

- Test for generalizability across demographic factors
  - Sex of respondent
  - Family composition
  - Population density of location
  - Geographic region
  - Child age (0 – 2, 3 – 5, 6 – 11, and 12 – 17 years of age) (parent-child DVs only).
- After analyses are complete, break out subsamples of the data set (one variable will be tested at a time, they will not be crossed)
  - Correlations will be compared across groups using r-to-z transformations
  - Regression and SEM results will be compared across groups using fully constrained multi-group analyses in Mplus
  - Analyses concerning age of child are more complex because parents can have multiple children and children are therefore nested within parent, a variable that can cross categories of child age, so analyses will all be within MPlus

RPF Study

- Feedback?
- Questions?

Algorithms

■ Goal

– Obtain accurate prevalence estimates of secretive behaviors from regularly collected data without directly assessing the behaviors themselves

■ Pilot work with archival data sets 1998 – 2002 suggested a regression based approach was viable

Algorithm Methodology

- Pool of non-sensitive variables and interactions

- Final variables/interactions selected/weighted via background stepwise logistic regression

- Cutpoints selected to optimize prevalence estimation

- Confidence intervals determined via bootstrapping

Algorithms to be Developed

I. ♂ →♀ Partner Physical Abuse (substantiatable)

II. ♂ →♀ Partner Physical Abuse (sub-threshold)

III. ♂ →♀ Partner Emotional Abuse

IV. ♂ →♀ Partner Sexual Abuse

V. ♀ →♂ Partner Physical Abuse (substantiatable)

VI. ♀ →♂ Partner Physical Abuse (sub-threshold)

VII. ♀ →♂ Partner Emotional Abuse

VIII. Parent→Child Physical Abuse (substantiatable)

IX. Parent→Child Physical Abuse (sub-threshold)

X. Parent→Child Emotional Abuse

XI. Parent→Child Neglect

XII. AD suicidality

XIII. AD drug use (prescription drug misuse)

XIV. AD drug use (illicit drugs)

XV. AD problem drinking

XVI. AD problem drinking (sub-threshold)

XVII. ♂ →♀ Any Partner Abuse

XVIII. ♂ →♀ Any Partner Abuse

XIX. Parent→Child Any Maltreatment

XX. Any Substantiatable Family Maltreatment

XXI. Any Secretive Problem (1-17)

Methodological Issues to be Addressed

- Considering using scales rather than items
- How to best deal with clustering in algorithm development
- Determine use of correction factor vs. multi-problem algorithms to know how to combine prevalences
- Have some statisticians review and determine if there are improvements that could be made
- (Maybe) predictive validity